

What is claimed is:

1. A starter comprising:
 - a motor generating a rotational force from its armature;
 - 5 a rotary output shaft driven by said motor;
 - a plurality of rolling-contact bearings aligned in an axial direction, each rolling-contact bearing having rolling members;
 - 10 a pinion shaft inserted in an inner cylindrical bore of each rolling-contact bearing so as to be supported by a housing via said rolling-contact bearings, disposed rotatably on said output shaft via a plain bearing, and shiftable on said output shaft in the axial direction; and
 - 15 a pinion gear attached in a cantilever fashion to a distal end of said pinion shaft opposed to said motor, and selectively meshing with a ring gear of an engine in a startup operation to transmit the rotational force of the motor to said ring gear.
2. The starter in accordance with claim 1, wherein said rolling-contact bearings comprise a first rolling-contact bearing and a second rolling-contact bearing arranged next to each other in the axial direction with a predetermined clearance therebetween.
- 20 3. The starter in accordance with claim 1, wherein each of said rolling-contact bearings is a ball bearing having balls serving as said rolling members.
- 25 4. The starter in accordance with claim 1, wherein each of said rolling-contact bearings has rollers or needles serving as said rolling members.
- 30 5. The starter in accordance with claim 1, further comprising a one-way clutch coupled around said output shaft via a helical spline coupling and shiftable on said output shaft in the axial direction together with said pinion shaft to transmit rotation of said output shaft to said pinion shaft,

wherein an axial end of said rolling-contact bearings closer to said motor is disposed closely to said one-way clutch when said pinion shaft is positioned far from said motor to engage the pinion gear to the ring gear.

5 6. The starter in accordance with claim 1, further comprising a one-way clutch coupled around said output shaft via a helical spline coupling and shiftable on said output shaft in the axial direction together with said pinion shaft to transmit rotation of said output shaft to said pinion shaft,

10 wherein a coupling clearance of said helical spline coupling is larger than a clearance between said rolling-contact bearings and said pinion shaft.

7. The starter in accordance with claim 1, wherein a clearance between said plain bearing and said output shaft is larger than a clearance between said rolling-contact bearings and said pinion shaft.

15 8. The starter in accordance with claim 1, wherein a speed reduction device is disposed between said armature and said output shaft to reduce rotation of said armature and transmit reduced rotation to said output shaft.

20 9. A starter comprising:

a motor generating a rotational force from its armature;

a rotary output shaft driven by said motor;

a ball bearing having a plurality rows of balls which are aligned in an axial direction and interposed between a pair of external and internal rings;

25 a pinion shaft inserted in an inner cylindrical bore of said ball bearing so as to be supported by a housing via said ball bearing, disposed rotatably on said output shaft via a plain bearing, and shiftable on said output shaft in the axial direction; and

30 a pinion gear attached in a cantilever fashion to a distal end of said pinion shaft opposed to said motor, and selectively meshing with a ring gear of an engine in a startup operation to transmit the rotational force of the motor to said

ring gear.

10. The starter in accordance with claim 9, further comprising a one-way clutch coupled around said output shaft via a helical spline coupling and
5 shiftable on said output shaft in the axial direction together with said pinion shaft to transmit rotation of said output shaft to said pinion shaft,

wherein an axial end of said ball bearing closer to said motor is disposed closely to said one-way clutch when said pinion shaft is positioned far from said motor to engage the pinion gear to the ring gear.

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11. The starter in accordance with claim 9, further comprising a one-way clutch coupled around said output shaft via a helical spline coupling and shiftable on said output shaft in the axial direction together with said pinion shaft to transmit rotation of said output shaft to said pinion shaft,

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wherein a coupling clearance of said helical spline coupling is larger than a clearance between said ball bearing and said pinion shaft.

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12. The starter in accordance with claim 9, wherein a clearance between said plain bearing and said output shaft is larger than a clearance between said ball bearing and said pinion shaft.

13. The starter in accordance with claim 9, wherein a speed reduction device is disposed between said armature and said output shaft to reduce rotation of said armature and transmit reduced rotation to said output shaft.

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